CLAIMS

What is claimed is:

1. A fuel cell system comprising:

a heating element comprising a body of thermally-conductive material having at least one channel, a hydrogen storage medium disposed within said channel, wherein said hydrogen storage medium is capable of absorbing and releasing hydrogen in a reversible reaction; and

a component of said fuel cell system in heat transfer relationship with said body and arranged so that hydrogen supplied to said channel is absorbed by said hydrogen storage medium in an exothermic reaction generating heat which is transferred through said body to said component.

2. The fuel cell system of claim 1, wherein said at least one channel comprises a plurality of flow channels.

3. The fuel cell system of claim 2, wherein said body has an opening providing access to said flow channels and wherein a filter is disposed between said opening and said flow channels to retain said hydrogen storage medium in said flow channels.

4. The fuel cell system of claim 3, wherein said hydrogen storage medium is in particle form.

5. The fuel cell system of claim 1, wherein said at least one component comprises a terminal collector element of a fuel cell, and said terminal collector element includes said heating element.

6. The fuel cell system of claim 1, wherein said at least one component comprises an electrically conductive fluid distribution element in a fuel cell, and said fluid distribution element includes said heating element.

7. The fuel cell system of claim 1, wherein said at least one component comprises adjacent fuel cells and wherein said heating element is disposed between said adjacent fuel cells.

8. The fuel cell system of claim 1, wherein said at least one component comprises a terminal fuel cell and a terminal collector plate of a fuel cell stack, and said heating element is disposed between said terminal fuel cell and said terminal collector plate.

9. The fuel cell system of claim 1, wherein said at least one component comprises a terminal collector plate and an end base plate of a fuel cell stack, and said heating element is disposed between said terminal collector plate and said end base plate.

10. The fuel cell system of claim 1, wherein said at least one component comprises a fuel cell stack and wherein said heating element surrounds at least a portion of said stack.

11. The fuel cell system of claim 1, wherein said body is constructed of a material which is electrically and thermally conductive.

12. The fuel cell system of claim 11, wherein said material is a polymeric composite.

13. The fuel cell system of claim 11, wherein said material is a metal.

14. The fuel cell system of claim 11, wherein said material comprises a metal selected from the group consisting of: aluminum, magnesium, titanium, nickel, stainless steel, and alloys and mixtures thereof.

15. The fuel cell system of claim 11, wherein said material comprises aluminum.

16. The fuel cell system of claim 15, wherein said material comprises at least one selected from the group consisting of: Al and $AlMg_3$.

17. The fuel cell of claim 1, wherein said hydrogen storage medium has an equilibrium pressure for absorption of hydrogen of less than about 30 atm at 25°C.

18. The fuel cell system of claim 1, wherein said hydrogen storage medium has an equilibrium pressure for absorption of hydrogen of less than about 5 atm at 25°C.

19. The fuel cell system of claim 1, herein said hydrogen storage medium has a hydrided state comprising metal hydride and a dehydrided state comprising metal or metal alloy represented by M.

20. The fuel cell system of claim 19 wherein said metal or metal alloy, M, absorbs hydrogen according to the general equation: $M(s)+H_2(g)\longleftrightarrow MH_y(s)$ where M is a solid phase metal alloy, hydrogen is in gaseous form, and MH is a solid phase metal hydride, and y is based on charge balance.

21. The fuel cell system of claim 19, wherein said metal alloy, M, is comprised of a composition having the nominal general formula selected from the group consisting of AB_5 and AB_2.

22. The fuel cell system of claim 21, wherein A is a first metal species selected from the group consisting of: lanthanum (La), neodynium (Nd), cerium (Ce), praseodymium (Pr), mischmetal (Mm), calcium (Ca), titanium (Ti), and mixtures thereof; and

B is a second metal species comprises a metal selected from the group consisting of: iron (Fe), tin (Sn), nickel (Ni), aluminum (Al), cobalt (Co), manganese (Mn), and mixtures thereof.

23. The heating element according to claim 22, wherein said metal alloy comprises $LaNi_5$.

24. The fuel cell system of claim 21, wherein B of said metal alloy is equal to the nominal general formula: $B_{a(1-x)}B_{b(x)}$, where B_a is a first metal; B_b is a second metal; and $x < 1$.

25. The fuel cell system of claim 20, wherein said metal alloy is selected from the group consisting of: $TiFe_{0.9}Mn_{0.1}$, $MmNi_{4.5}Al_{0.5}$, and $MmNi_{4.5}Mn_{0.5}$, and $ZrFe_{1.5}Cr_{0.5}$.

26. The fuel cell system of claim 21, wherein A of said metal alloy is equal to the nominal general formula: $A_{a(1-y)}A_{b(y)}$ where A_a is a first metal or mixed metal, A_b is a second metal or mixed metal, and $y < 1$.

27. The fuel cell system of claim 26, wherein said metal alloy comprises $Ca_{0.7}Mm_{0.3}Ni_5$.

28. The fuel cell system of claim 19, wherein said metal alloy is selected from the group consisting of: $LaMm(NiSn)_5$, $TiMn_{0.5}$, $Ti_{0.98}\ Zr_{0.02}\ V_{0.43}\ Fe_{0.09}\ Cr_{0.05}\ Mn_{1.5}$, $TiV_{0.62}Mn_{1.5}$, and TiFe.

29. A fuel cell system comprising:

a heating device comprising a thermally conductive body having a cavity which contains a metal alloy, wherein said metal alloy when exposed to hydrogen at temperatures below 60°C and below 15 atm absolute reversibly forms a metal hydride and thereby releases heat; said heating device in heat transfer relationship with a component of said fuel cell system.

30. The fuel cell system of claim 29 wherein said cavity contains particles of said metal alloy.

31. A method of heating a fuel cell system comprising:

contacting gaseous hydrogen with a hydrogen absorption material comprising a metal alloy that reacts with hydrogen to form a metal hydride and thereby generate heat; and

transferring said generated heat to a component of the fuel cell system.

32. A method of heating a fuel cell system from a start-up condition, said method comprising:

providing a storage vessel containing a hydrogen absorption material having an equilibrium pressure defined by the temperature of the material and the ratio of hydrogen incorporated into said material, wherein said material undergoes a reversible reaction by absorbing hydrogen exothermically when a pressure in said vessel exceeds said equilibrium pressure at a given temperature, and by desorbing hydrogen endothermically when said pressure in said vessel is less than said equilibrium pressure at a given temperature;

introducing hydrogen gas to said storage vessel at a pressure exceeding said equilibrium pressure of said material;

generating heat by contacting said hydrogen gas with said material for absorbing hydrogen thereinto; and

transferring said generated heat to a component of said fuel cell system.

33. The method according to claim 32, further including after said transferring, releasing hydrogen from said material when a temperature of said component reaches or exceeds a temperature of the storage vessel and when said equilibrium pressure exceeds a pressure in said vessel.